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Public Buildings Enhanced Energy Efficiency Program

Final Report
Investigation Results For
Minnesota Retirement Systems

Date: 2/8/2012

Admin Minnesota

DEPARTMENT OF ADMINISTRATION

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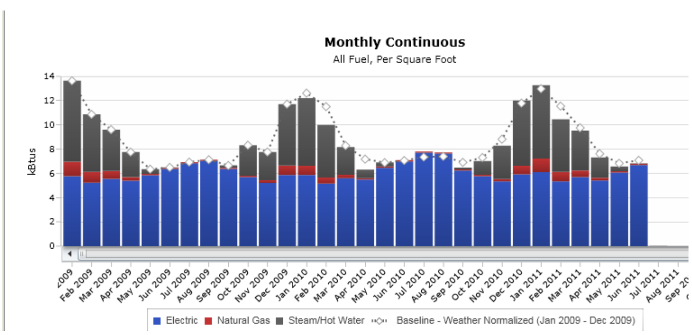
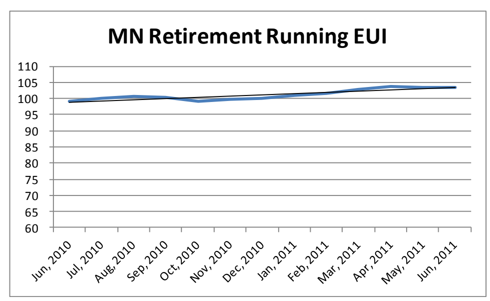
Minnesota Retirement Systems Building Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Minnesota Retirement Systems Building was performed by Hammel, Green and Abrahamson, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$28,722		Total Project Cost	$45,137
Future costs including Implementation , Measurement & Verification	$16,415		Study and Administrative Cost Paid with ARRA Funds	($33,722)
Total Project Cost	$45,137		Utility Co-funding	($19,769)
			Total costs after co-funding	($8,354)
Estimated Annual Total Savings ($)	$11,791		Estimated Annual Total Savings ($)	$11,791
Total Project Payback	3.8		Total Project Payback with co-funding	<0
Electric Energy Savings (37,578 of 3,173,130 kWh (2010))	**1.0%**	**and**	**District Energy Savings (Hot Water) (181 of 3,582 MMBtu (2010))**	**5.0%**





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	146,981	15,172,041	15,172,041	0	0%	$344,699.34	$0.02
2010	365	146,981	14,693,952	15,159,121	-465,169	-3%	$337,405.08	$0.02
2011	211	146,981	8,284,604	9,396,436	-1,111,832	-12%	$181,190.54	$0.02

Minnesota Retirement Systems Building Consumption Report
Total energy use increased about 4% during the period of the investigation due to an independent project; it is expected to return to the previous level this summer

Admin Minnesota DEPARTMENT OF ADMINISTRATION STATE OF MINNESOTA B3 BENCHMARKING

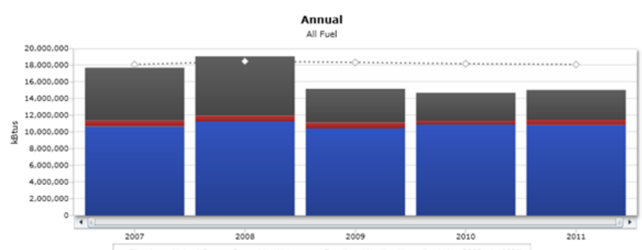
Summary Tables

Minnesota Retirement Systems Building	
Location	60 Empire Drive, St. Paul, MN
Facility Manager	Gordon Specht
Number of Buildings	1 (includes parking garage)
Interior Square Footage	146,981 plus 113,000 for parking garage
PBEEEP Provider	Hammel, Green and Abrahamson, Inc.
Annual Energy Cost	\$337,405 (2010) Source: B3
Utility Company	Xcel Energy (Electric and Natural Gas) District Energy St Paul (Hot Water)
Site Energy Use Index (EUI)	103 kBtu/ft^2 (at end of study, excluding garage area)
Benchmark EUI (from B3)	103 kBtu/ft^2

Building Name	State ID	Area (Square Feet)	Year Built
MN Retirement Systems	G6310000001	146,981	2001
MN Retirement Systems Parking	G0231046262	113,000	2001

Mechanical Equipment Summary Table (of buildings included in the investigation)	
Quantity	**Equipment Description**
1	Building Automation System (Honeywell EBI)
6	Air Handlers
210	VAV Boxes
2	Centrifugal Chillers
6	Pumps (2 HW,2 CHW,2 CDW)
350	Approximate number of points recommended for trending

5 Year Energy Use Shows a 15.8% decrease from the B3 Baseline Year



Implementation Information			
Estimated Annual Total Savings ($)			$7,076
Total Estimated Implementation Cost ($)			$11,415
GHG Avoided in U.S Tons (CO2e)			45
Electric Energy Savings (kWh) 1.2 % Savings 2011 Electric Usage 3,173,130 kWh (from B3)			37,578
Electric Demand Savings (Peak kW) 0 % Savings 2010 Peak Demand 645 kW (from B3)			0
Natural Gas Savings (Therms) 0 % Savings 2011 Gas Usage 6,303 Therms (from B3)			0
District Hot Water Savings (kBtu) 5.0% Savings 2011 District Hot Water usage 3,582 MMBtu from B3			181
Statistics			
Number of Measures identified			3
Number of Measures with payback < 3 years			2
Screening Start Date	10/28/2010	Screening End Date	11/29/2010
Investigation Start Date	12/29/2010	Investigation End Date	11/21/2011
Final Report	1/27/2012		

Minnesota Retirement Systems Building Cost Information			
Phase		**To date**	**Estimated**
Screening		$2,636	
Investigation [Provider]		$21,900	
Investigation [CEE]		$4,186	$1,000
Implementation			$11,415
Implementation [CEE]			$2,000
Measurement & Verification		0	$2,000
Total		$28,722	$16,415

Co-funding Summary	
Study and Administrative Cost	$33,722
Utility Co-Funding - Estimated Total ($)	$19,769
Total Co-funding ($)	$53,491

Facility Overview

The energy investigation identified 3.0% of total energy savings at Minnesota Retirement Systems Building with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Minnesota Retirement Systems Building are based on adjusting the schedule of equipment to match actual building occupancy hours. The total cost of implementing all the measures is $11,415.

Implementing all these measures can save the facility approximately $11,791 a year with a combined payback period of 3.0 years before rebates. After rebates the site will have no costs. These measures will produce 1.0% electrical savings and 5.0% steam/hot water savings. The building is currently performing at the Minnesota Benchmarking and Beyond database (B3) benchmark value.

The primary energy intensive systems at Minnesota Retirement Systems Building are described here:

The building gets hot water from District Energy St. Paul and produces its own chilled water with two centrifugal chillers located in the penthouse. The chillers are water cooled and have two cooling towers on the roof. The four large AHUs at MN Retirement Systems work in pairs, two for the west side of the building and two for the east. They supply air into a common supply duct that runs the entire height of the building. They all have humidifiers installed that run off of natural gas. There is perimeter hot water radiation on all floors.

The building has one natural gas meter, one electrical meter, and one district energy hot water meter. The gas meter only supplies the four humidifiers attached to the large AHUs.

The building is fairly new (2001) and very few changes have occurred. The majority of the interior lighting at the campus is 32W T8 fixtures and is controlled by wall switches. There are some daylighting sensors in the open office spaces on each floor, but they are currently not being used.

The site Energy Use Index (EUI) for the campus is 103.4 kBtu/ft^2, which is about the same as the B3 Benchmark of 103.6 kBtu/ft^2. The benchmark is in the process of being adjusted in B3 as it did not account for the energy use in the parking garage.

Findings Summary

Building: MN Retirement Systems Building
Site: MN Retirement Systems

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	EF-1 Runtime	$4,000	$6,132	0.65	$1,917	0.34	32
2	RTU Runtime	$3,000	$481	6.23	$727	4.72	7
5	Entry lighting levels are on for excessive hours and lighting levels are elevated	$4,415	$463	9.53	$700	8.02	7
	Total for Findings with Payback 3 years or less:	**$4,000**	**$6,132**	**0.65**	**$1,917**	**0.34**	**32**
	Total for all Findings:	**$11,415**	**$7,076**	**1.61**	**$3,344**	**1.14**	**45**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Investigation Checklist

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Rev. 2.0 (12/16/2010)

14600 - MN Retirement Systems Building

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a.Equipment Sc	a.1 (1)	Time of Day enabling is excessive	EF, RTU, AHU 3,4 excessive operation	Garage Roof/Mech Penthouse		Equipment Runtime could be reduced
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	Lights are off when people are not present in spaces. Verified during site visits. Trended sample areas to verify overnight lighting levels.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	LGB
b.Economizer/	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	Sequence of operation calls for economizer damper to modulate to maintain 2 degree offset of MAT and DAT. Unit damper modulates well to maintain this 2 degrees between about 5 degrees and 70 degrees F.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	Minimum OA set to accommodate space pressurization as well as makeup air for exhaust systems.
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	LGB
c.ControlsP	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Not Relevant	Facility does not operate heating and cooling at the same time.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	CO2/OA measuring stations faulty	Penthouse	Not cost-effective to investigate	CO2 Return air sensor faulty and two OA airflow measuring stations are faulty. No energy savings present with this finding.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Not Relevant	
d.Controls(Setpoi	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not cost-effective to investigate	System has been disabled due to occupancy discomfort. Fully dimming system too exspensive to replace existing step dimming.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Not Relevant	AHU's turned off during unoccupied times. This was verified during shoulder and winter.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not cost-effective to investigate	LGB
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	LGB
e.	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	The building operates at low water temperatures at all times. The hot water loop temperature does reset with respect to OAT.

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14600 - MN Retirement Systems Building

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Chilled water delta T is above 10 degrees most of the time (Across all OAT)
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	during summer, internal loads dominate cooling for building. DAT is already above 60 degrees.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	VFD modulates based off schedule and OAT.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Condenser Water resets slightly, primarily at 80 degrees.
	e.6 (22)	Other Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	DAT setpoint change to be addressed during summer
f. Equipment E	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not cost-effective to investigate	Most lighting appears to be off when nobody present. Dimming system has been disabled but not cost
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	Triple duty valves 70-80% open, minimal savings by making adjustments
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.			Not Relevant	
	f.5 (27)	OTHER Equipment Efficiency/Load Reduction			Not Relevant	
g. Variable	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	Equipment suited well for VFD's already have them in place and operational.
	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	Equipment suited well for VFD's already have them in place and operational.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER VFD			Not Relevant	
h. Retrofits	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	Newer motors are efficient.
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers			Not Relevant	Facility utilizes Heat exchanges and district energy.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	HW supply utilizes heat exchanger and chilled water utilizes variable primary configuration.
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	

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14600 - MN Retirement Systems Building

This checklist is designed to be a resource and reference for Providers and PBEEEP.

indingCategory:	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting	Entry Lighting Excessively Bright	Entry		T8 Lighting throughout. Provide alternative lighting option for entryway.
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. MaintenanceR	**i.1 (46)**	Differed Maintenance from Recommended/Standard			Not Relevant	Clean systems and facility
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	Clean systems and facility
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	Dampers have been verified to be modulating and not stuck in position
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	Temperatures do not indicate any issues related to stuck valves
	i.5 (48)	OTHER_Maintenance			Not Relevant	
j. O	**j.1 (49)**	OTHER			Not Relevant	

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**	
		• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**	
		• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**	
		• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**	
		• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**	
		• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**	
		• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**	
		• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**	
		• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**	
		• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**	
		• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**	
		• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**	
		• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**	
		• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
		• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**	
		• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**	
		• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**	
		• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**	
		• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**	
		• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**	
		• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**	
		• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**	
		• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**	
		• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**	
		• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**	
		• Please contact PBEEEP Project Engineer for approval

Findings Details

Building: MN Retirement Systems Building

FWB Number:	14600	Eco Number:	1
Site:	MN Retirement Systems	Date/Time Created:	2/6/2012

Investigation Finding:	EF-1 Runtime	Date Identified:	4/1/2011
Description of Finding:	As indicated by the Facility Engineer, the Exhaust fans need to be addressed for occupancy and appear to be operating more than required. In addition to the exhaust fan motor energy, it was discovered the AHU's move into freeze protection mode multiple times in one night. The trend data shows the AHU MAT and DAT cycling about 8 times in one night of trend data. It is assumed the freeze protection is caused by the infiltration due to the exhaust fan operation.		
Equipment or System(s):	Other	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Facility/Controls	Benefits:	Energy Savings
Baseline Documentation Method:	Physical Verification/Trending with Data Loggers		
Measure:	Discontinue operating EF-1 during unoccupied times. Interlock EF to operate with existing AHU schedule of 6:00 AM - 6:00 PM.		
Recommendation for Implementation:	Current EF operation allows fan to operate 24/7. Upon discussions with Scott Miron, it was discovered the unit can be interlocked with AHU operation with minimal work so fan operates when AHU operates. Recommendation for EF is for controls contractor to interlock EF with AHU operation. The exhaust fan can be interlocked with the AHU's because the AHU's operate as required for the occupancy of the building. The exhaust fan operation shall follow the AHU operation as it will then follow the building occupancy schedule.		
Evidence of Implementation Method:	Evidence of Implementation: is to include trending of EF operation with the use of a data logger for a 1 week period to ensure fan operation tracks AHU operation. In addition to trending the EF use, trending of the supply fan speed, MAT, DAT, Min OA flow, and OAT for a minimum of two weeks at 15 minute intervals shall be conducted. The trend data should show the AHU operation continues to operate from 6:00 AM until 6:00 PM and the exhaust fan shall follow. In the heating season and during unoccupied times when the AHU is off, the unit should not move into freeze protection as often as it currently does.		

Annual Electric Savings (kWh):	21,541	Annual District Energy-Hot Water Savings (Gallons):	181,296
Estimated Annual kWh Savings ($):	$1,269	Est Annual District Energy-Hot Water Savings ($):	$4,863
Contractor Cost ($):	$1,000		
PBEEEP Provider Cost for Implementation Assistance ($):	$3,000		
Total Estimated Implementation Cost ($):	$4,000		

Estimated Annual Total Savings ($):	$6,132	Utility Co-Funding for kWh ($):	$1,917
Initial Simple Payback (years):	0.65	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.34	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	32	Utility Co-Funding - Estimated Total ($):	$1,917

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	86.6%	Percent of Implementation Costs:	35.0%

Findings Details

PBEEEP State Government

Building: MN Retirement Systems Building

FWB Number:	14600	Eco Number:	2
Site:	MN Retirement Systems	Date/Time Created:	2/6/2012

Investigation Finding:	RTU Runtime	Date Identified:	4/1/2011
Description of Finding:	As indicated by the Facility Engineer, the air handling unit runtime could be reduced since they are operating more than required. (This applies to the Parking Garage RTU)		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Facility/Controls	Benefits:	Energy Savings
Baseline Documentation Method:	Physical Verification/Trending with Data Loggers		
Measure:	Discontinue operating unit during unoccupied times. Interlock RTU with existing AHU schedule of 6:00 AM - 6:00 PM.		
Recommendation for Implementation:	Current RTU operation is 24/7. Provide interlock of RTU with current AHU schedule of 6 AM to 6 PM to allow RTU to operate at a reduced operating schedule. Provide a user adjustable control night setback point for freeze protection for space during winter operation to ensure the space does not freeze.		
Evidence of Implementation Method:	Evidence of Implementation: is to include trending of RTU operation with the use of a data logger for a 1 week period to ensure fan operation tracks AHU operation. Trend AHU operation during winter conditions to ensure AHU operates when space temperature drops below night setback temperature setpoint.		

Annual Electric Savings (kWh):	8,172	Contractor Cost ($):	$2,000
Estimated Annual kWh Savings ($):	$481	PBEEEP Provider Cost for Implementation Assistance ($):	$1,000
		Total Estimated Implementation Cost ($):	$3,000

Estimated Annual Total Savings ($):	$481	Utility Co-Funding for kWh ($):	$727
Initial Simple Payback (years):	6.23	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	4.72	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	7	Utility Co-Funding - Estimated Total ($):	$727

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	6.8%	Percent of Implementation Costs:	26.3%

Findings Details

Building: MN Retirement Systems Building

FWB Number:	14600	Eco Number:	5
Site:	MN Retirement Systems	Date/Time Created:	2/6/2012

Investigation Finding:	Entry lighting levels are on for excessive hours and lighting levels are elevated	Date Identified:	8/1/2011
Description of Finding:	Upon conversations with the building engineer, it was discovered the lighting level within the entryway could be addressed to determine if energy savings are present. The 8 downlights are each 250 Watt MH bulbs (295 Watt fixture load) and do not take into account any of the outside light. The entryway has a great deal of windows and could utilize outside light and reduce the fixture usage in the space. In addition, the 6 wall sconces are on 24/7 and the downlight bulb could be replaced to reduce overall energy consumption. By replacing the downlight portion of the fixture, the total fixture load would reduce from 100 watts to 65 watts. The downlight portion of the wall sconce would get changed from a 89 watt load to a 45 watt load. In addition to changing the downlight section of the wall sconces, reduction in total hours of operation will also help to reduce energy consumption.		
Equipment or System(s):	Interior Lighting	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Lighting is on more hours than necessary		

Implementer:	Electrical Contractor	Benefits:	Energy Savings
Baseline Documentation Method:	The entry lighting wall sconces were trended for a 13 day period and it was discovered the lights were on 24/7. Through discussions with the building engineer, it was discovered the overhead downlights are only off from 11:00 PM - 6:00 AM Monday through Friday and off on weekends.		
Measure:	Replace the 8 downlights with lower wattage fixtures and step dimmable fixtures. Provide a photocell to allow entryway lights to step dim when exterior lighting levels are acceptable. Replace downlight portion of wall sconces with more efficient bulb type and reduce wall sconce lighting hours of operation as energy saving measure.		
Recommendation for Implementation:	Replace the (8) lobby ceiling downlights with (8) Williams model #PH12342TCSMWTAC/CG5EB2. Provide (1) Leviton Mini Z Controller and (1) Leviton Daylight Sensor. Utilize the controller and daylight sensor to allow lobby downlights to step dim to various levels based on daylight entering the space. Provide (6) new Solais LED 1100 Lumen PAR 30 in the (6) wall sconces to replace the existing MCP39 Par 20. Allow wall sconces to operate same daily hours as lobby downlights (off from 11:00 PM until 6:00 AM and off weekends).		
Evidence of Implementation Method:	Evidence of Implementation: is to verify equipment installation with the use of cutsheets or verification through site visits. Lighting data loggers can be used to determine if wall sconces are off overnight or on 24/7. Testing of daylight sensor to verify if lights step dim during varying light levels will demontrate operation of new lighting system.		

Annual Electric Savings (kWh):	7,865	Contractor Cost ($):	$3,415
Estimated Annual kWh Savings ($):	$463	PBEEEP Provider Cost for Implementation Assistance ($):	$1,000
		Total Estimated Implementation Cost ($):	$4,415

Estimated Annual Total Savings ($):	$463	Utility Co-Funding for kWh ($):	$700
Initial Simple Payback (years):	9.53	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	8.02	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	7	Utility Co-Funding - Estimated Total ($):	$700

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	6.5%	Percent of Implementation Costs:	38.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Architecture | Engineering | Planning

DRAFT

February 6, 2012

WRITER'S DIRECT DIAL 612-758-4227

Mr. Gordon Specht
Building Manager
Administration Department
50 Sherburne Avenue
St. Paul, Minnesota 55155

Re: Minnesota State Retirement System Building
HGA Commission Number 0476-046-00

Dear Mr. Specht:

Please see below for additional findings of the PBEEEP Investigation.

Return Air CO_2 sensor for AHU-1 is incorrect or out of calibration.
When looking at the return air CO_2 sensor for AHU-1, the reading is incorrectly elevated. Upon spot measurements, it was verified the return air CO_2 is much lower than what the sensor is reading. The CO_2 sensor is in place to reset the minimum outside air damper position. Upon further verification with trend data, it was discovered the minimum outdoor air damper position is modulating to maintain approximately 5,200 CFM. It was evaluated and discovered that no significant energy savings could be calculated by calibrating or replacing the CO_2 sensor as it was a very minimal amount. The minimum outdoor air could be reduced slightly with the sensor correctly calibrated so it would still be beneficial to correct this CO_2 sensor.

Minimum Outdoor Airflow Measuring Station not calibrated or reading incorrectly.
When looking at the minimum outdoor airflow measuring station for AHU-2A and 2B, the airflow measuring station is reading a constant value close to 100 CFM for each AHU. This is causing the minimum outdoor air damper to maintain a damper position of 100% at all times. The airflow measuring stations are in place to maintain 5,200 CFM of OA at all times, so the incorrect measurement of 100 CFM is causing the incorrect damper position. Energy savings could not be calculated as the economizer dampers modulate over a very wide range of outdoor air temperature, so the minimum outdoor air requirements would only be valid at temperatures in excess of 70° Fahrenheit and below 10° Fahrenheit. Due to the limited hours the AHU is operating at temperatures with minimum OA percentages, it was difficult to calculate savings to appropriately pay for a new airflow measuring station. It would still be beneficial to correct this

airflow measuring station to slightly reduce the outdoor air CFM for temperatures outside the given range of 10° Fahrenheit to 70° Fahrenheit.

AHU equipment operation 24/7 during summer.
It was discovered during the investigation the AHU equipment during the summer was operating 24/7. This operation was a change in scheduling when compared to both winter and shoulder season trend data investigations. It was decided not to include this additional energy usage within the study as the equipment operation was an isolated situation. The equipment was being utilized for cooling of a data center area as the building was going through a construction project to update data center equipment. Upon construction completion, the air handling equipment will be altered back to its original schedule.

Ramp Lighting Investigation
The original scope of the investigation study was to include an investigation of the ramp lighting energy and potential savings to utilizing a more efficient lighting option. Through discussions with building staff it was discovered the ramp lighting was already going through a lighting retrofit project. The ramp lighting investigation was removed as a direct result of this discovery.

Daylight Controls for Perimeter Lighting
The existing daylight controls for the perimeter office space is currently disabled. This was discussed with the facility engineer and determined that occupants had too many issues with the step dimming system as it was very noticeable when the lights would switch between different lighting levels. It was decided that returning the system back to its original specification would cause many occupant complaints and would not be a good solution. A fully modulating dimming system was researched as a possible solution. The implementation of the new system resulted in a lengthy payback, not meeting the requirements of the program.

VFD Operation
Upon verification of trend data, the VFD speeds generally range from 40-65%. This information is a demonstration of why a reduction in fan speed was difficult to arrive at for additional energy savings. In previous years, the facility made some controls strategy changes including setpoint alterations which assisted in additional energy savings. From the B3 site, it can be verified that a 15% reduction in energy consumption took place.

Please contact me directly with any questions at 612-758-4227 or tmell@hga.com.

Sincerely,

Todd Mell, LEED AP
Mechanical Department

cc: Kate Zwicky, HGA

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414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

MN Public Employees Retirement
Pat Ferrin
60 Sherburne Ave G10
St. Paul, MN 55155

1/31/12

Dear Pat:

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed and approved your Recommissioning study. Please review the results with your Xcel Energy representative, Barb Jerhoff.

After they have presented the report to you, please submit the following to your Xcel Energy representative:

- Completed Recommissioning Study Rebate Application
- Copy of the paid study invoice
- Completed Customer implementation plan, which can be found in the 2nd tab of the attached rebate form

After we receive these, we will process your study rebate check and mail it to you. **Remember, you need to submit these within 3 months.**

We encourage you to implement the measures recommended in your report. When you know which measures you plan on implementing, please notify you Xcel Energy representative.

Your Recommissioning implementation rebate form is also enclosed. When you have implemented any of the recommissioning measures, please sign and date a copy of the rebate form and include the costs per measure implemented on the 2nd tab. Send this along with your itemized invoices to your Xcel Energy Account Manager.

Earn Bonus Rebates by Implementing Within 9 Months!

You can now earn a significant bonus rebate (up to 100%) if you implement and submit your recommissioning measures within nine months of this study approval date.

You will earn an additional \$0.03/kWh and/or \$3/Dth on ALL qualifying RCx measures submitted within 9 months of study approval. That's in addition to the \$0.045/kWh and/or \$5/Dth you can already earn for measures that have paybacks 9 months - 15 years. Normally, you can't earn rebates on measures with paybacks less than 9 months, but now is your chance to earn rebates on ALL recommissioning measures, even those that are low to no cost with quick paybacks!

Bonus details:

- Max bonus rebate is \$10,000 or the total out-of-pocket costs for the study – whichever is lower. You could potentially pay \$0 out-of-pocket for your recommissioning study!

- All recommissioning energy-saving measures are eligible for a rebate, including measures that pay back in less than nine months.
- Invoices and signatures must be dated May 1, 2011 or later to qualify.
- Available for recommissioning measures only (prescriptive and custom measures identified in the study do not qualify).
- This bonus cannot be combined with any other bonus offer or bundle.
- The bonus ends Dec. 31, 2012 or nine months from your study approval date, whichever is earlier.
- Available in MN only.

For further questions about the bonus, please call your Xcel Energy Account Manager.

Sincerely,

Alex Birkholz
Marketing Assistant, Recommissioning

Attachment

CC: Barb Jerhoff - Xcel Energy
Sherryl Volkert - Xcel Energy
Todd Mell - HGA. Inc.

Xcel Energy Minnesota Recommissioning/Engineering Assistance Study
Energy Conservation Opportunities Form

Instructions: The engineering firm should complete and include a copy of this form in every Recommissioning and Engineering Assistance Study. This form will automatically calculate an estimated recommissioning rebate. If the opportunity is custom in nature, please place an X in column M. If the opportunity qualifies for a prescriptive rebate, the engineering firm should estimate the prescriptive rebate and enter it in column K. Customer must sign/date form upon completion of recommissioning measures and return a copy of this form and all related equipment/labor invoices to the customer's Xcel Energy Account Manager. Before using this spreadsheet, in Excel, go to Tools/Macro/Security. Make sure that the Security Level is set to Medium or Low. If Security had been set on High, you will need to exit and then relaunch Excel in order for the setting to take effect. If Security is set on Medium, you will need to select the "Enable Macros" button in order for the Recommissioning Tool to function correctly.

V 12.01 MN

Customer Information

Date: 1/31/2012
Company name: **MN Retirement Systems Building**
Complete service address: 50 Sherburne Ave G10, St. Paul, MN 55155
Customer contact name: Gordon Specht
Customer contact phone:
Electric premise number: 302324067
Gas premise number: 302324067

Engineering Firm Information

Prepared by (Engineering Firm): HGA
Contact Name: Todd Mell
Phone: 612-758-4227
E-mail*: tmell@hga.com
Study Approval Date: 1/31/2012
Xcel Energy Account Manager: Barb Jerhoff

For use with projects invoiced 1/1/10 or later

Average Annual Energy Use: (See Note #15 Below)

kW:	736	0%
kWh:	3,188,316	1%
Dth:	5,820	0%

Minnesota RCx Bonus

Total Study Cost: $21,900
Approved Study Rebate: $16,425
Potential MN Bonus: **$1,326**
Rebate Limit: (See Note #12)

Type of Customer*

- ☑ Xcel Energy Electric Customer
- ☑ Xcel Energy Natural Gas Customer [Not Transport]
- ☐ District Energy Chilled Water Customer
- ☐ District Energy Hot Water/Steam Customer
- ☐ District Energy is Xcel Electric Customer
- ☐ District Energy is Xcel Natural Gas Customer

* Check the appropriate box indicating if the customer is an Xcel Energy electric and/or gas customer. Checking the appropriate box will calculate the appropriate recommissioning rebate. Refer to Note #10, #13, #14 below for more information on District Energy qualifications

Building Energy Recommissioning Savings														District Energy Recommissioning Savings			
ECO#	Energy Conservation Opportunity	Estimated Summer Peak Demand Savings (kW)	Estimated Annual Energy Savings (kWh)	Estimated Gas Energy Savings (Dth)	Estimated Annual Electric Cost Savings	Estimated Annual Gas Cost Savings	Estimated Other Cost Savings	Estimated Gross Cost of Opportunity	Simple Payback *Estimate (years)* w/ Base Rebate	Simple Payback *Estimate (years)* MN RCx Bonus (See Note #12)	Enter the Estimated Prescriptive Rebate	Estimated RCx Conservation Rebate: Base Rebate	Estimated RCx Conservation Rebate: MN RCx Bonus (See Note #12)	Peak Ton Reduction (tons)	Ton-Hour Reduction (ton-hours/yr)	Steam Reduction (Mlbs/yr)	Hot Water Savings (MWh/yr)
Recommissioning Opportunities																	
1	EF-1 Runtime		25,342		$1,269	$0		$4,000	2.24	1.64		$1,157	$760				63
2	RTU Runtime		9,614		$481			$3,000	5.32	4.72		$439	$288				
3	Return Air CO2 sensor is incorrect or out of calibration.		0		$0			$0					$0				
4	Minimum Outdoor Airflow Measuring Station not calibrated or reading incorrectly.		0		$0			$0					$0				
5	Entry lighting levels are on for excessive hours and lighting levels are elevated		9,253		$463			$4,415	8.62	8.02		$423	$278				

Maintenance Opportunities (Coil Cleaning, unplugging valves, etc.)

Xcel Energy Recommissioning/Engineering Assistance Study
Energy Conservation Opportunities Form

ECO#	Energy Conservation Opportunity	Estimated Summer Peak Demand Savings (kW)	Estimated Annual Energy Savings (kWh)	Estimated Gas Energy Savings (Dth)	Estimated Annual Electric Cost Savings	Estimated Annual Gas Cost Savings	Estimated Other Cost Savings	Estimated Gross Cost of Opportunity	Simple Payback *Estimate (years)*		Enter the Estimated Prescriptive Rebate	Estimated Recommissioning Conservation Rebate		Peak Ton Reduction (tons)	Ton-Hour Reduction (ton-hours/yr)	Steam Reduction (Mlbs/yr)	Hot Water Savings (MWh/yr)
Prescriptive Opportunities - The savings and rebate values are estimates only. Xcel Energy will determine final rebate after you submit a prescriptive rebate application.																	
Custom Efficiency or Energy Management System Opportunities - The energy savings listed in this section are estimates only. Xcel Energy will determine final savings numbers for purposes of calculating potential rebates after you apply for the Custom/EMS program.																	
Other Savings Opportunities (Non-Rebatable energy savings, rate savings, load management, water savings, etc.)																	
TOTALS																	
	Recommissioning	0.00	44,208	0	$2,214	$0	$0	$11,415	4.24	3.65		$2,019	$1,326	0	0	0	63
	Prescriptive	0.00	0	0	$0	$0	$0	$0	0.00		$0			0	0	0	0
	Custom	0.00	0	0	$0	$0	$0	$0	0.00					0	0	0	0
	Other	0.00	0	0	$0	$0	$0	$0	0.00					0	0	0	0
	Total	0.00	44,208	0	$2,214	$0	$0	$11,415	4.24	3.65	**$0**	**$2,019**	**$1,326**	0	0	0	63

RULES & REQUIREMENTS

01. By signing this form, customer does hereby certify that 1. All recommissioning work is complete and operational prior to submitting rebate application; and 2. All rules of this Xcel Energy program have been followed. Further, the customer acknowledges that participation in the rebate program shall impose no liability on Xcel Energy. In particular, Xcel Energy shall not be liable for the work performed by the customer's engineer, contractor, or vendor. Energy savings are estimates only. Actual savings may vary.
02. Actual rebate amounts subject to review by Xcel Energy. Measures implemented more than two years after study approval date will be reviewed and rebate recalculated.
03. Rebates are available for Xcel Energy electric and retail natural gas business customers in Minnesota only.
04. Customers must apply for rebates within one year of the purchase date shown on equipment invoice for a given measure.
05. Xcel Energy's conservation rebate programs are subject to 60 days' notice of cancellation. The customer is responsible for checking with the Business Solution Center at 1-800-481-4700 to ask whether or not the program is still in effect and to verify program parameters.
06. Customer should sign all implemented maintenance and recommissioning lines and submit to Xcel Energy Account Manager, along with invoices, upon completion to determine final rebate amount.
07. Customer is responsible for providing actual costs for each recommissioning measure implemented.
08. Xcel Energy reserves the right to conduct inspections of installations and/or make a reasonable number of follow-up visits to customer's facility to verify measure implementation and/or verify energy savings.
09. For Custom Efficiency or Energy Management System opportunities, customer is responsible for applying for preapproval before purchasing equipment in order determine and qualify for a rebate.
10. In order for energy saving to be tabulated in the District Energy Recommissioning section, the provider of the Chilled Water, Hot Water, or Steam must use Xcel Energy as their fuel source for each product. See notes #13 & #14 for more information.
11. Vendor shall complete data entries in all unshaded colums (A-I), including zero (0) values, to generate simple payback and rebate calculations.
12. In Minnesota, the maximum total potential rebate bonus per building is the lower of the following: $10,000 or the customer's out of pocket cost for the study, where out of pocket cost = study cost minus approved study rebate as outlined in your study approval letter. The actual bonus amount is dependant on the individual measures implemented and may vary from the amounts shown in column N. The bonus is available for measures implemented within 9 months of the customers study approval date and invoiced 5/1/11 or later in MN.
13. Select district is an Xcel electric customer box only if the customer uses: St. Paul Chilled Water, Hennepin Cty Energy Center Chilled Water, or NRG Chilled Water.
14. Select district is an Xcel gas customer box only if the customer uses: St. Paul Heating Water.

Public Buildings Enhanced Energy Efficiency Program

ATTACHMENT 4: SCREENING RESULTS FOR MINNESOTA RETIREMENT SYSTEMS

November 17, 2010

Campus Overview

MN Retirement Systems	
Location	60 Empire Drive, St. Paul, MN
Facility Manager	Gordon Specht
Number of Buildings	1 (includes parking garage)
Interior Square Footage	146,981
PBEEEP Provider	Center for Energy and Environment (Gustav Brändström)
Date Visited	11/5/2010
Annual Energy Cost	$334,700 (2009) Source: B3
Utility Company	Xcel Energy (Electric and Natural Gas) District Energy St Paul (Hot Water)
Site Energy Use Index (EUI)	103.4 kBtu/ft^2
Benchmark EUI (from B3)	113.6 kBtu/ft^2

MN Retirement Systems in St. Paul, MN is a 5 story 146,981 square foot (ft^2) building of office space. The facility is located in St. Paul, MN.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of MN Retirement Systems was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on November 5, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

An investigation of the energy usage and energy savings opportunities of the building listed below totaling 146,981 interior square feet at MN Retirement Systems is recommended.

Building Name	**State ID**	**Square Footage**	**Year Built**
MN Retirement Systems	G6310000001	146,981	2001
MN Retirement Systems Parking Ramp	G0231046262	113,000	2001

Details obtained through the screening process are included in the following:

Mechanical Equipment

The building gets hot water from District Energy St. Paul and produces its own chilled water with two centrifugal chillers located in the penthouse. The chillers are water cooled and have two cooling towers on the roof. The four large AHUs at MN Retirement Systems work in pairs, two for the west side of the building and two for the east. They supply air into a common supply duct that runs the entire height of the building. They all have humidifiers installed that run off of natural gas. There is perimeter hot water radiation on all floors. It was mentioned during the interviews with building staff that some operational changes with regard to the availability of hot water and chilled water were tested and abandoned because of comfort issues.

The following table lists the key mechanical equipment at the facility.

Mechanical Equipment Summary Table	
Quantity	**Equipment Description**
1	Building Automation System (Honeywell EBI)
1	Building
146,981	Interior Square Feet
6	Air Handlers
210	VAV Boxes
2	Centrifugal Chillers
6	Pumps (2 HW,2 CHW,2 CDW)
350	Approximate number of points recommended for trending

Controls and Trending

All of the large mechanical equipment in the building is controlled by the Honeywell EBI building automation system. All of the major equipment has pneumatic actuation but DDC control, and the VAV boxes have DDC actuation and control. The system is capable of trending and the trend data can be exported in text format. Plant Management Department will collect and deliver the trends wanted in CSV format. The points on the automation system for the mechanical equipment are listed in the Building Summary Table below.

Energy Use Index B3 Benchmark

The site Energy Use Index (EUI) for the campus is 103.4 kBtu/ft^2, which is about 9% lower than the B3 Benchmark of 113.6 kBtu/ft^2. Per the building data in the system, data center space usage makes up 3,000 square feet; however, the footprint appears to be smaller than this based on observation through screening. The B3 data was updated and the benchmark was revised to 103.9 kBTU/ft^2. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks.

Metering

The building has one natural gas meter, one electrical meter, and one district energy hot water meter. The gas meter only supplies the four humidifiers attached to the large AHUs.

Documentation

There is a significant amount of mechanical documentation, including equipment schedules, mechanical plans, balance reports, and control sequences available at the site or at the Plant Management Division (PMD) office. The building is fairly new (2001) and very few changes have occurred.

Lighting

The majority of the interior lighting at the campus is 32W T8 fixtures and is controlled by wall switches. There are some daylighting sensors in the open office spaces on each floor, but they are currently not being used.

Reasons for Recommendation

The reasons that MN Retirement Systems is recommended to move forward with an energy investigation include full automation of HVAC equipment, large air handling units, and the Energy Use Index (EUI) for the site is approximately at the B3 Benchmark EUI. Buildings that meet their benchmarks often have opportunities to lower their energy use through recommissioning.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, a building walk-through, automation system screen-captures, and equipment documentation. The purpose of the tables is to provide the size and quantity of equipment and the level of control present in each building. They are complete and accurate to the best of our knowledge.

MN Retirement Systems			State ID# G6310000001 & G0231046262		
Area (sq.ft)	146,981	Year Built	2001	Occupancy (hrs/yr)	4,368
HVAC Equipment					

Air Handlers

Description	**Type**	**Size**	**Notes**
AHU-1A	AHU-VAV	SF 50 hp 32,000 cfm RF 20 hp 28,000 cfm	Serves Main Bldg (West) Has humidification
AHU-1B	AHU-VAV	SF 50 hp 32,000 cfm RF 20 hp 28,000 cfm	Serves Main Bldg (West) Has humidification
AHU-2A	AHU-VAV	SF 50 hp 32,000 cfm RF 20 hp 28,000 cfm	Serves Main Bldg (East) Has humidification
AHU-2B	AHU-VAV	SF 50 hp 32,000 cfm RF 20 hp 28,000 cfm	Serves Main Bldg (East) Has humidification
AHU-3	AHU-CV	SF 2 hp 1,600cfm	Serves Chiller Room
AHU-4	AHU-CV	SF 1.5 hp 1,050 cfm	Serves Elevator Equip/ Electrical Room
RTU-1	RTU-CV	SF 7.5 hp, 5,500cfm 12 tons of cooling	Serves Parking Ramp elevator lobby and connection to building.

VAV Boxes

Description	**Type**	**Size**	**Notes**
1st Flr: 45 VAVs	VAV Box	65-2,200 cfm	Most have HW Reheat
2nd Flr: 50 VAVs	VAV Box	65-2,200 cfm	Most have HW Reheat
3rd Flr: 54 VAVs	VAV Box	65-2,200 cfm	Most have HW Reheat
4th Flr: 58 VAVs	VAV Box	65-2,200 cfm	Most have HW Reheat
Penthouse: 3 VAVs	VAV Box	65-2,200 cfm	Most have HW Reheat

Hot Water System

Description	**Type**	**Size**	**Notes**
WHE-1	Heat Exchangers	3,500 kBtu/h	30% Glycol in HW System
WHE-2	Heat Exchangers	3,500 kBtu/h	30% Glycol in HW System
P-1	Heating Water	400 GPM 15hp	Has VFD
P-2	Heating Water	400 GPM 15hp	Has VFD

MN Retirement Systems State ID# G6310000001 & G0231046262					
Area (sq.ft)	146,981	Year Built	2001	Occupancy (hrs/yr)	4,368
HVAC Equipment (continued)					

Chilled Water System

Description	Type	Size	Notes
CH-1	Chiller	400 Tons (2X)	
CH-2	Chiller	400 Tons (2X)	
CT-1A	Cooling Tower	915 GPM 20 hp	VFD on Fan
CT-1B	Cooling Tower	915 GPM 20 hp	VFD on Fan
P-3	Chilled Water Pump	800 GPM 25 hp	
P-4	Chilled Water Pump	800 GPM 25 hp	
P-6	Condenser Water Pump	915 GPM 20 hp	
P-7	Condenser Water Pump	915 GPM 20 hp	

Exhaust Fans

Description	Size	Notes
E-1	5 hp, 8,600 cfm	Serves General Exhaust
E-2	2 hp, 4,800 cfm	Serves Cafeteria
PRV-1	0.25hp, 900 cfm	Serves Loading Dock
PRV-2	0.33hp, 2,000 cfm	Serves Chiller Rm
PRV-3	0.25 hp, 215 cfm	Serves Chiller Rm
E-3		Serves Parking Ramp

Computer Room Units

Description	Type	Size	Notes
MCU-1	CRAC Unit	6 Tons	Location: Rm 440
MCU-2	CRAC Unit	9 Tons	Location: Rm 383
MCU-3	CRAC Unit	9 Tons	Location: Rm 383
MCU-4	CRAC Unit	6 Tons	Location: Rm 331
MCU-5	CRAC Unit	3 Tons	Location: Rm 331

MN Retirement Systems		State ID# G6310000001 & G0231046262			
Area (sq.ft)	146,981	Year Built	2001	Occupancy (hrs/yr)	4,368
Points on BAS					

Air Handlers

Description	Points
AHU-1A AHU-1B AHU-2A AHU-2B	SF-S and Speed, RF-S and Speed, DSP and Setpoint, DAT and Setpoint and Reset, Humidifier Valve Position, CLG-VLV Pos, HTG-VLV Pos and Booster Pump Status, MAT and Setpoint, Rat, RARH, RA Static Pressure, MA Static Pressure, Min OA Damper Pos, Economizer Damper Pos, RA Damper Pos, EA Damper Pos, Min OA CFM and Setpoint and Reset, OAT, OA Enth, RA Enth, Space Static Pressure and Setpoint
AHU-3 AHU-4	SF-S, DAT and Setpoint and Reset, HTG-VLV Pos, MAT, OA Damper Pos, Zone Temp and Setpoint
RTU-1	SF-S, RAT, DAT, Zone Heating Coils, Zone Temperature and Setpoint

VAV Boxes

Description	Points
VAVs	Supply Air Flow and Setpoint, Damper Position, Heating Valve Position (on most), Zone Temp and Heating and Cooling Setpoint, Radiation Valve Position (on some) Floor plan with VAV locations for all floors is on BAS also.

Hot Water System

Description	Points
HW System	District HWST and HWRT, District HW VLVs, Heating Enable Setpoint, HW Pump Status and Speed, HWST and Setpoint and Reset, HWRT, HWDP and Setpoint

Chilled Water System

Description	Points
CHW System	Chiller Status and %Load, Chiller Water Supply Temp, CHWST and Setpoint, CHWRT, CHW Pump Status and Speed, CHW-DP and Setpoint, Chiller Enable Setpoint.
Cooling Towers	Tower Fan Status and Speed, CDW Pump Status, CDWST and Setpoint

Typical Floor Plan at MN Retirement Systems

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH